Interim Development Report
for
DEVELOPMENT OF LOW-NOISE TRAVELING-WAVE TUBES

This report covers the period 1 July 1961 through 31 July 1961

MICROWAVE ELECTRONICS CORPORATION
3165 Porter Drive
Palo Alto, California

Navy Department Bureau of Ships, Electronics Division
Contract NObsr-81227, Index Number SS-021001/S. T. 21

CONTENTS

ILLUSTRATIONS

1. ABSTRACT

1.1 During this period, the construction and testing of the 200-volt helix was accomplished. The measured helix phase velocity corresponded to a cold voltage of 205 volts and an operating voltage of approximately 215 volts. These measurements were made on a four-rod supported helix with less than a 2:1 ratio of barrel to helix diameter.

2. PART I: TECHNICAL REPORT

2.1 Purpose

2.1.1 Phase II of the contract is for the design and development of L-band low-noise TWT's and for delivery of four final design samples.

2.2 General Factual Data

2.2.1 Identification of Technicians

2.2.1.1 The names of various technical personnel involved in this contract and the man-hours worked are reported in the covering letter accompanying this report.

2.2.2 Patents

2.2.2.1 No patents have been issued during this report period.

2.2.3 References

2.2.3.1 No new references are applicable to this report.

2.3 Detailed Factual Data

2.3.1 Helix Design

2.3.1.1 The considerations of low-noise operation appear to dictate a beam voltage on the order of 200 volts. In opposition to this, both the focusing and power output requirements dictate a higher beam voltage. To keep the PPM-focusing parameters in a reasonable range, the voltage should be closer to 300 volts. This beam voltage will be consistent with the necessary power output at a beam current of 0.8 ma.

2.3.1.2 With these ideas in mind, two helix designs were chosen. One design was for 200 volts to satisfy the low-noise considerations, and one was at 350 volts to simplify the focusing

problem. The lower voltage helix was constructed during this period, and cold measurements were made using the conventional cavity-matching scheme, as shown in Fig. 1.

2.3.2 Cold Measurement of the Helix

2.3.2.1 Cold measurement is very important in controlling the tube performance. From it one can obtain sufficient information for control of the helix assembly, because this measurement is made before the helix assembly is completed.

2.3.2.2 The equipment setup is the standard reflectometer setup for matching. From this measurement, the following can be determined.

- The helix phase velocity
- The helix match
- Magnitude and position of reflections which will cause fine structure
- Helix attenuator characteristics

2.3.2.3 The most important measurement at this point in the development is that of the helix cold phase velocity. This measurement was performed on the low-voltage helix, resulting in a measured phase velocity corresponding to 205 volts. With a beam current on the order of 1 ma, the operating voltage is approximately 5 per cent higher, resulting in a 215-volt helix.

2.3.3 Conclusions

2.3.3.1 The helix design for 200 volts and the construction techniques for the four-rod support assembly have been successful.

2.3.3.2 See Fig. 2 for the proposed program schedule.

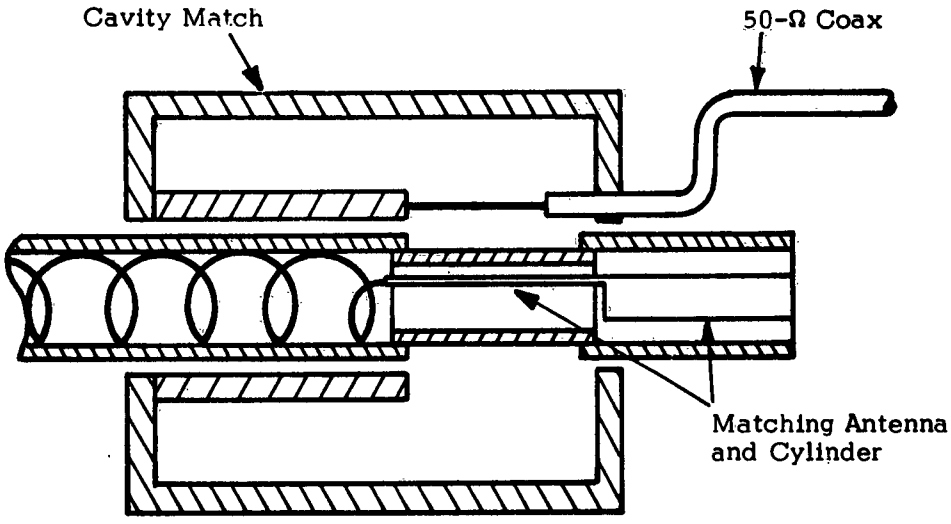

Fig. 1. Cavity matching used in the low-voltage helix cold testing.

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Project Performance and Schedule
Index SS-021001/S. T. 21

Contract No. NObsr-81227 (Report) Date: July 1961

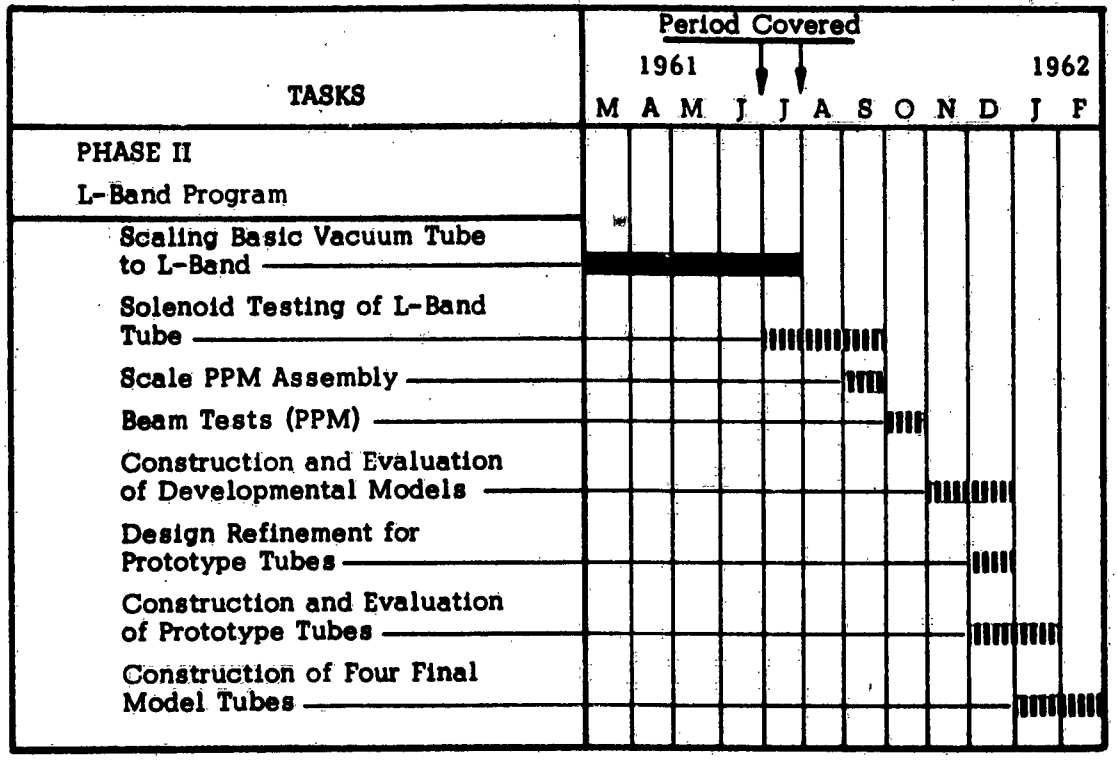

Fig. 2. Proposed program schedule.

3. PART II: PROGRAM FOR NEXT INTERVAL

3.1 The program for the next interval will include the following.

- Broadband matching of the 200-volt helix
- Initial solenoid testing of the 200-volt helix tube